

OBSERVATIONS OF HUMPBACK WHALES (*MEGAPTERA NOVAEANGLIAE*) ON A CRUISE TO NEW CALEDONIA AND THE CHESTERFIELD REEFS

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During a yacht-based survey in the austral winter of 1992, low numbers of humpback whales were observed around the main island of New Caledonia, and humpback song was recorded there. The song, the first recorded in New Caledonian waters, showed similarities to song recorded off eastern Australia. No humpback whales were detected at Chesterfield Reefs in the eastern Coral Sea, despite their possible status as a breeding area. Only a small portion of the Chesterfield Plateau was surveyed. Reports of sightings there in recent years indicate at least occasional visitation by humpback whales.

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Group V humpback whales feed in Antarctic Area V (130°E-170°W) during the austral summer and segregate into tropical breeding areas in the southwest Pacific during winter (Dawbin, 1966). Catch data of 19th century American pelagic whalers indicated wintering, and presumably breeding, concentrations around Tonga, Fiji, and the Chesterfield Reefs in the Coral Sea (Townsend, 1935). French whalers killed humpbacks in the Loyalty Islands of New Caledonia, as well as at the Chesterfield Reefs (du Pasquier, 1982). Many American whalers also visited parts of New Caledonian waters during the 19th century (Langdon, 1984). Humpbacks were marked by Dawbin using "Discovery" tags around Vanuatu and the Loyalty Islands during the late 1950s, but no marks were recovered (Dawbin, 1964). Recent incidental sightings data, unreported at the outset of this study, indicate that humpback whales, including newborn calves, are now frequently seen in New Caledonian waters during winter and spring (Garrigue and Gill, 1994). There has been speculation, based on Townsend's (1935) charts, as to whether Chesterfield Reefs are still a humpback breeding destination (Dawbin and Falla, 1949; Paterson, 1991).

This paper describes a yacht-based cruise during the austral winter of 1992, initially to investigate whether humpback whales migrate to New Caledonia and the Chesterfield Reefs. While in New Caledonian waters the study focused on humpback song, never recorded in the region, for comparison with other areas.

METHODS

The 15-metre cutter "Iniquity" was equipped with GPS navigation, depth sounder (max. depth 100m), radar, weatherfax, wind instruments and seawater thermometer. With a minimum of 2 observers, continuous visual monitoring was carried out (except when interrupted by sailing duties) from deck 2-3m above sea level (distance to horizon 5.6-6.7km) while the vessel was making way. In sheltered lagoon waters where whales were more likely to be encountered, when the vessel's motion allowed, an observer was positioned up the mast 12m a.s.l. (distance to horizon 13.5km).

"Iniquity" departed Coffs Harbour, New South Wales on 7 July 1992, and sailed northeast to Noumea. Nearly 4 weeks were spent in New Caledonian waters from 14 July, and the passage westward across the Coral Sea to Queensland took place during 11-31 August (Fig. 1). This timing allowed the vessel to be in these areas around the estimated peak of the east Australian humpback breeding season (Simmons and Marsh, 1986; Paterson, 1991).

Humpback song may be detected over tens of kilometres (Cato, 1991), a much greater range than visual observation permits. It is commonly heard in breeding areas and on coastal migration routes, even in darkness. On a previous yacht-based study in Australian waters, humpbacks were detected 3 times more often by song than by sight (Dawbin and Gill, 1991). For these reasons

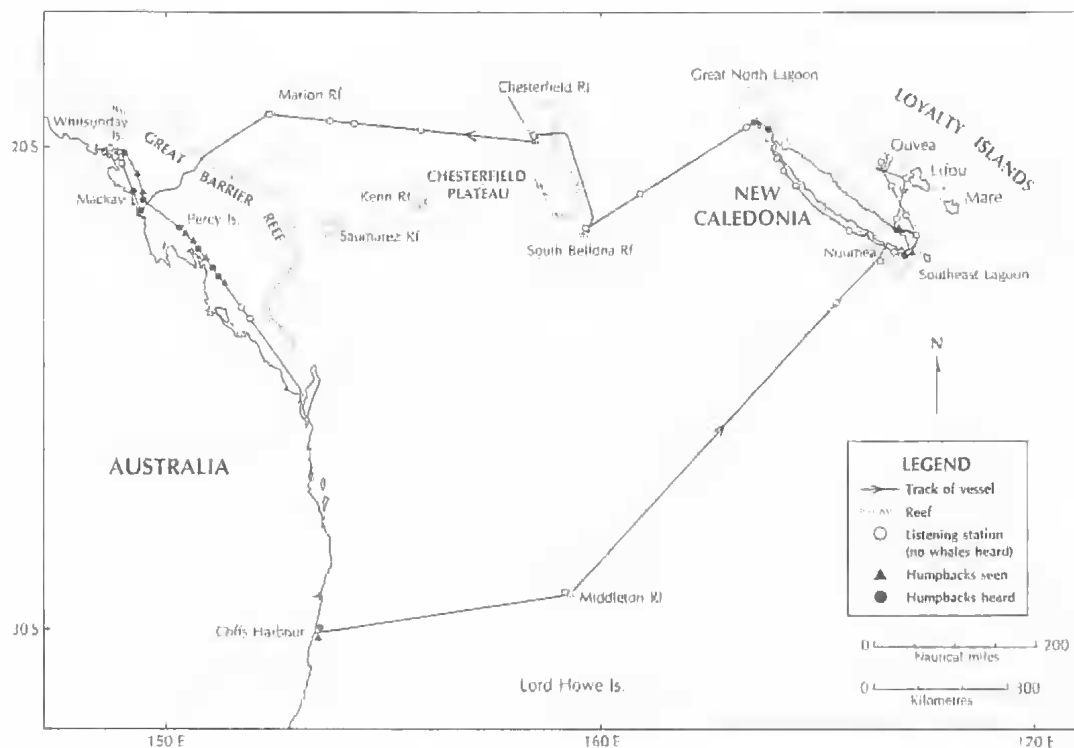


FIG. 1. Map showing the route taken by the vessel, locations of humpback whale sightings, and listening stations.

acoustic monitoring was regarded as the primary detection method for this study.

Hydrophone soundings were taken for about 10 min every 3–4 hours while at sea (approximately every 30 km) when conditions allowed, in order to ensure that the same animals were not detected at more than one listening station. Soundings were taken not only near coastlines, islands and reefs, but also distant from land, in order to ascertain possible migration routes (Clapham & Mattila, 1990). Monitoring was also conducted when whales were sighted. A minimum of 20 min was recorded whenever possible, to ensure covering at least 1 full song cycle. Acoustic equipment consisted of an Edmund Scientific 41759 hydrophone, connected via a 40 dB preamplifier with high pass filter to a Sony WMD6-C cassette recorder. System response was 30 Hz–6 kHz.

Song from New Caledonia was compared with song from Eden (southbound migration, 1991) and Coffs Harbour (northbound migration, 1992), New South Wales (Table 2). Song analysis was both aural and spectrographic. Cato (1991) has noted that humpback whale sounds are well suited to human aural perception. Songs are com-

posed of units, phrases and themes (Cato, 1991). For this comparison, units were denoted by subjective descriptive terms (e.g., "yap", "moan") in the order in which they occur (Table 4). Phrases were used as the measure of aural comparison. Sonograms of selected segments of song were made with a Kay Elemetrics DSP Sono-Graph model 5500-1 (Fig. 2). Analysis filter bandwidth was 15 Hz.

RESULTS

DETECTION OF WHALES

No humpback whales were detected at Ouvéa and Lifou in the Loyalty Islands, although only

TABLE 1. Humpback whales sighted, New Caledonia

Date	Position	Locality	Number
19 Jul 1992	22°24'S 166°52'E	Southeast Lagoon	2
27 Jul 1992	21°57'S 166°51'E	east coast	1
2 Aug 1992	22°25'S 166°55'E	Southeast Lagoon	2

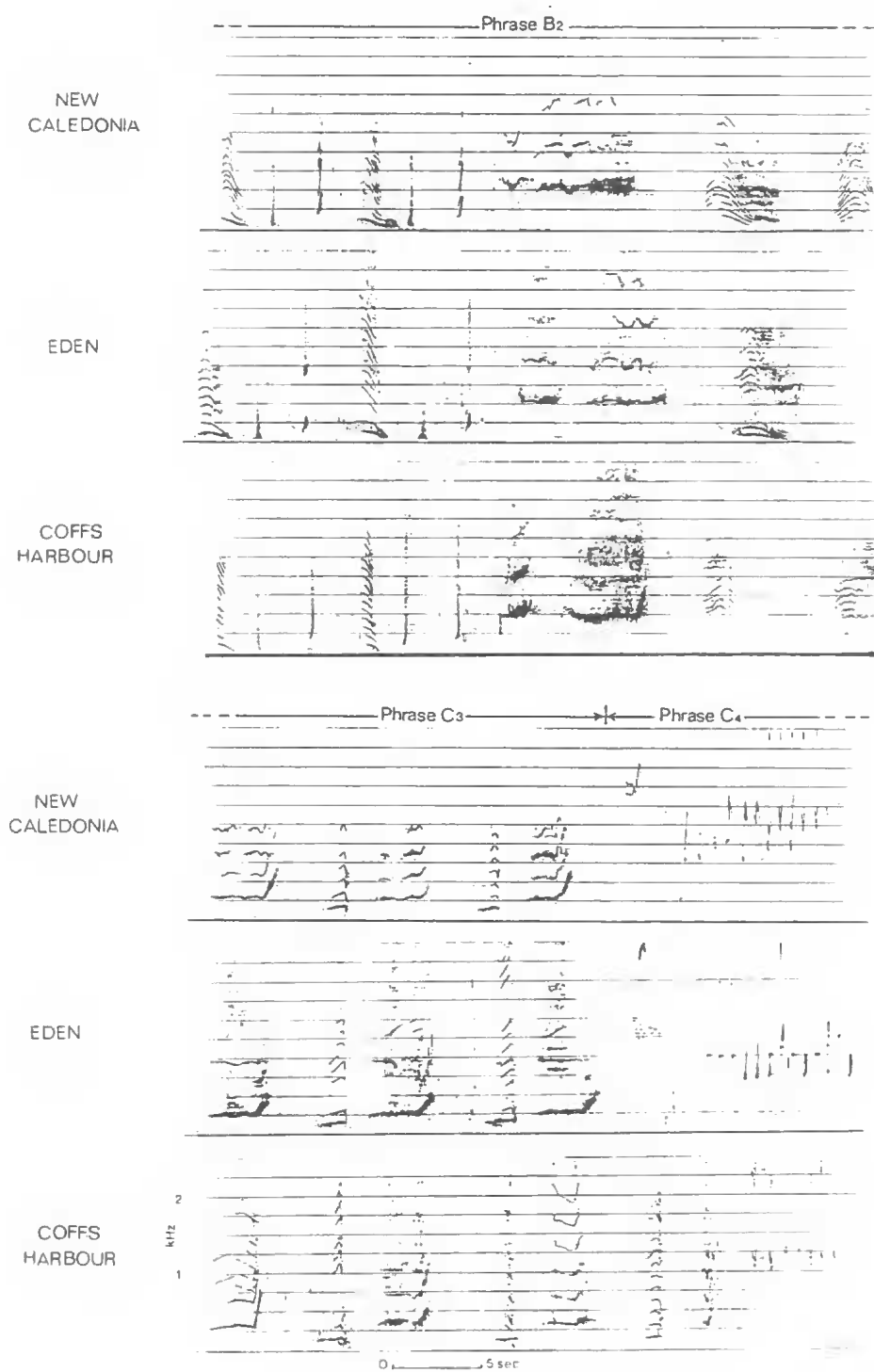


FIG. 2. Sonograms showing comparison of segments of song phrases from New Caledonia and two locations on the east coast of Australia. Samples shown are not consecutive.

TABLE 2. Locations of humpback song heard, number of whales singing, and duration of recordings.

Date	Position	Locality	Singing	Duration
17 Nov 91	37°00'S 150°00'E	Australia: Eden	1	90 min
06 Jul 92	30°18'S 153°09'E	Coffs Harbour	1	90 min
2 Aug 92	22°25'S 166°55'E	New Caledonia: Southeast Lagoon (Cap Nouva)	1	107 min
16 Aug 92	19°44'S 163°55'E	Great Northern Lagoon	1	19 min
16 Aug 92	19°36'S 163°35'E	Great North Lagoon (I. Belep)	1	15 min
18 Aug 92	19°30'S 163°33'E	Great North Lagoon (I. Belep)	1	60 min

small areas around these islands were examined due to strong winds. Five humpbacks in 3 pods were sighted in the east and southeast of the main island of New Caledonia during 463 km travelled in lagoon waters (Fig. 1; Table 1). These sightings have been included in the incidental sightings study of Garrigue and Gill (1994). Wind strengths exceeded 30 kmh⁻¹ for more than half of the period spent in New Caledonian waters, making both visual and acoustic detection of whales difficult at these times.

Song was detected and recorded on four occasions in New Caledonian waters, off both south-east and northwest extremities of the main island (Table 2). Song was heard during only one of three sightings due to wind-induced water noise during the other two. Humpbacks were detected in the Great North Lagoon of New Caledonia by sound alone; visual monitoring in good to excellent conditions detected no whales.

No humpback whales were detected during a 22-hr visit to South Bellona Reef (21°53'S, 159°28'E) at the southern end of Chesterfield Plateau in calm clear conditions on 20-21 August. The vessel was anchored during this period, and visual and acoustic observations were made at 2-hourly intervals. No humpback whales were detected in the Chesterfield Reefs lagoon (19°55'S, 158°25'E) during 22-26 August, despite reasonable to excellent conditions. Though the vessel traversed the lagoon twice, it was anchored most of the time. The entire lagoon was visible, and was scanned several times per day from the vessel's mast, while at anchor. A hydrophone was continuously deployed, and was mon-

itored for 10 min every 2 hour except during periods of sleep.

No humpback whales were detected in open ocean waters, or during visits to Middleton and Marion Reefs in the Coral Sea (Fig. 1). After entering the Great Barrier Reef at 20°15'S on 31 August, humpback song was frequently heard between 20°04'S, 149°05'E and 22°54'S, 151°05'E, where monitoring was discontinued on 20 September. At times up to 4 whales could be heard singing simultaneously, and several humpbacks were seen, including 4 cow-calf pairs. A notable exception was within the Whitsunday Islands, where heavy vessel traffic was evident, and no whales were seen or heard.

SONG ANALYSIS

Songs from the three areas compared here (New Caledonia Southeast Lagoon, Eden, Coffs Harbour) each have three themes, and show a high degree of shared phrases, as determined by aural comparison (Table 3). Coffs Harbour shared 89% of phrases with both Eden and New Caledonia, while Eden and New Caledonia shared 78% of phrases. A transcript of the aural comparison is shown in Table 4.

Spectrographic analysis of selected phrases (B2, C3, C4) shows similarities in structure and pattern of humpback sound types from the three areas (Fig. 2).

DISCUSSION

New Caledonia. Useful information was obtained from acoustic monitoring during this study. Song was heard on four occasions, and humpback whales sighted on three. Acoustic monitoring extended the known distribution of humpbacks into the Great North Lagoon, a large

TABLE 3. Shared and unique song phrases.

Phrase	Eden	Coffs Harbour	New Caledonia
A1	X	X	X
2	X	X	X
B1	X	X	
2	X	X	X
3	X	X	X
C1	X	X	X
2	X	X	X
3	X	X	X
4	X		
4A		X	X

TABLE 4. Aural comparison of humpback song, using subjective descriptive terms. Symbols: (R) repeated; (P) pause; ↑ upward; (2) unit repeated, Unit in bracket repeated.

Theme	Phrase	Descriptive terms for units
A	1	gloop-low moan-gloop(2)-low moan(2)-cries-cows
	2	Payne cries-shorter cries into chirps
B	1	[gloop-woo cry (P) woo cry-woo cry (P)-lower cries into whistles] - (R)
	2	[↑ moan-woo cry (P) woo cry (P) woo cry-lower cries into whistles] - (R)
	3	[↑ moan-woo cry (P) woo cry - ↑ moan-long moan-raspy whistle chirps
C	1	↑ moan(2)-long low moan - ↑ moan-long low moan
	2	[very short moan-undulating medium groan] - (R)
	3	[very short moan-ratchet moans] - (R)
	4	yaps
Song characteristics:		
• dominant (most frequent) theme is B		
• phrase B2 repeated most often		
• medium-length song		
b) Coffs Harbour, 6 July 1992		
A	1	[gloop-low moan-gloop (2) - low moan-gloop (2) - cries-cows] - (R)
	2	[Payne cries-shorter cries into chirps] (R)
B	1	[gloop-woo cry (P) woo cry (P) woo cry-lower cries into whistles] - (R)
	2	[↑ moan-woo cry (P) woo cry (2) - ↑ moan-woo cry-lower cries into whistles] - (R)
	3	[↑ moan-woo cry (P) woo cry - ↑ moan-long moan (P) long moan - raspy whistle chirps
C	1	↑ moan (2)- long low moan - ↑ moan-long low moan
	2	[very short moan-undulating medium moan] - (R)
	3	[very short moan-ratchet moans] - (R)
	4A	upward whistle-yaps
Song characteristics		
• short song; dominant theme probably A		
• themes quite short		
• B2 has extra cry since Eden		
c) New Caledonia, 2 August 1992		
A	1	[gloop-low moan-gloop (2)-low moan-gloop (2)-cries-cows] - (R)
	2	[Payne cries-shorter cries into chirps] - (R)
B	2	[↑ moan-woo cry (P) woo cry (2) - ↑ moan-woo cry-lower cries into whistles] - (R)
	3	[↑ moan-woo cry (P) woo cry - ↑ moan-long moan raspy whistle chirps
C	1	↑ moan-long low moan - ↑ moan-long low moan
	2	[very short moan-undulating medium moan] - (R)
	3	[very short moan-ratchet moans] - R
	4	upward whistle - yaps
Song characteristics		
• short song; dominant theme probably A		
• some units no longer repeated e.g. moan of C1, long moan of B2		
• B1 of previous songs no longer present		

and rarely-visited area where no sightings had been reported. It also permitted the first song comparison that we know of between songs from two Group V breeding areas.

Although song was recorded after the vessel entered north Queensland waters, it is not used here for comparison with New Caledonian song. The songs from Eden and Coffs Harbour were most similar in pattern to New Caledonian song, while the north Queensland song had evolved substantially since July 1992. Change of song with time may be complex even along a single migration path (Cato, 1991), let alone between breeding areas as well as seasons. Here we attempt only to report similarities between songs from New Caledonia and east Australia, and these

similarities are most apparent in the examples we have used.

Humpback song is considered to be an indicator of stock identity (Payne & Guinee, 1983); songs tend to show decreased similarity with increased geographical separation within ocean basins, and little or no similarity between ocean basins (Winn et al. 1981; Helweg et al., 1990; Dawbin & Eyre, 1991). While some differences were found between the songs compared here (such as the number of repetitions, or the omissions of units or phrases), such variation can occur between individuals in the same area, or even between different song renditions by an individual (Dawbin & Eyre, 1991). But the song from the three areas was basically similar. The Coffs Harbour song

shared as many phrases with New Caledonia as with Eden (Table 3), while the closest resemblances in spectrographic structure appear to be between New Caledonia and Eden (Fig. 2).

Given the relatively close proximity of New Caledonia and east Australia, and that Group V breeding grounds extend at least to Fiji (Dawbin, 1966) and probably Tonga, the similarities in song reported here are not surprising. An anticipated migratory connection between New Caledonia and other Group V breeding grounds was established in 1993 by a photo-identification match with Hervey Bay, Queensland (Garrigue & Gill, 1994). The similarities in song reported here add further evidence for migratory exchange between humpback whale sub-populations of New Caledonia and east Australia.

Chesterfield Reefs. There are numerous reefs on the Chesterfield Plateau. Townsend's (1935) chart shows a wide spread of points representing humpbacks killed by American whalers between July and October (approximately 45% of them in August), centred around Chesterfield Reefs, toward the northern end of the Plateau. French pelagic whalers operated there at least in 1862 and 1864 (du Pasquier, 1982). The Chesterfield Reefs lagoon is the most sheltered body of water on the Plateau, enclosing roughly 85 sq km. It meets the criteria cited by Whitehead & Moore (1982) as humpback breeding habitat, offering shelter, having suitable depths (average 50m) and warm water (23°C in August 1992). It would have provided whaling vessels with safe anchorage and easy access to whales in or near the lagoon. Numerous whale bones, some of them with marks from chopping implements still visible, have been located by divers in the lagoon (B. Crouch, pers. comm.).

Only two reliable reports have been obtained of humpbacks at Chesterfield Reefs during this century. In June-July 1972, 5-10 humpbacks were seen, and song heard by divers, inside the Chesterfield Reefs lagoon (R. & V. Taylor, pers. comm.). More recently, a humpback mother and calf were observed in the same lagoon over several weeks during September-October 1990 (B. Crouch, pers. comm.). This observer has not seen humpbacks during other frequent visits to Chesterfield Reefs in recent winters. Several French Government (ORSTOM) scientific expeditions during the past decade, including bathymetric surveys of the Plateau itself, have reported no sightings in winter and spring months (B. Richer de Forges, pers. comm.).

Due to bad weather the vessel did not traverse the main body of Chesterfield Plateau during this cruise, visiting only South Bellona and Chesterfield Reefs, for 22 hours and 5 days, respectively. During these periods no whales were observed or heard in good to ideal monitoring conditions. These observations are inconclusive, however, as whales may have been present elsewhere on the Plateau, or at Chesterfield Reefs earlier or later than the yacht's visit. The determination of the current status of Chesterfield Plateau's reefs as a humpback breeding area therefore awaits a more comprehensive study.

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